



Arizona Department of Transportation

# Response to Governor's Order for Bridge Review

September 7, 2007



# ADOT Response to Governor's Order for Bridge Review

## Executive Summary

Governor Janet Napolitano proactively called for a review of state bridges on August 2, 2007, to ensure the continued safety and condition of the state's bridges. This report presents an overview of the bridge preservation and inspection programs at the Arizona Department of Transportation (ADOT) as well as the results of the review of bridges in response to the Governor's order.

Arizonans can have confidence in the condition of our bridges as they have annually rated among the best in the nation. Key reasons for Arizona's strong ratings include our dry climate, the relatively young age of many structures, modern engineering design and the inspection and preservation programs associated with our bridges.

While we have been expanding our transportation system to meet the growth of our state, maintenance of our transportation infrastructure is a priority. ADOT spends more than \$20 million annually on bridge preservation.

ADOT has a thorough bridge inspection program and safety is the agency's primary concern. Bridge inspectors rate every component of a bridge using stringent standards co-developed by the Federal Highway Administration and the American Association of State Highway and Transportation Officials.

Confidence in the condition of state highway bridges remains strong. Less than one percent of ADOT bridges are listed as "structurally deficient," which means they need some type of repair. Bridges listed as "structurally deficient" are being repaired or assessed for future repairs. If ADOT were to determine a bridge to be unsafe, the bridge would be closed immediately until repairs were completed.

ADOT takes great pride in delivering a safe, quality transportation system for all of Arizona. Our commitment includes maintaining a safe system of highways, bridges and other state transportation facilities.

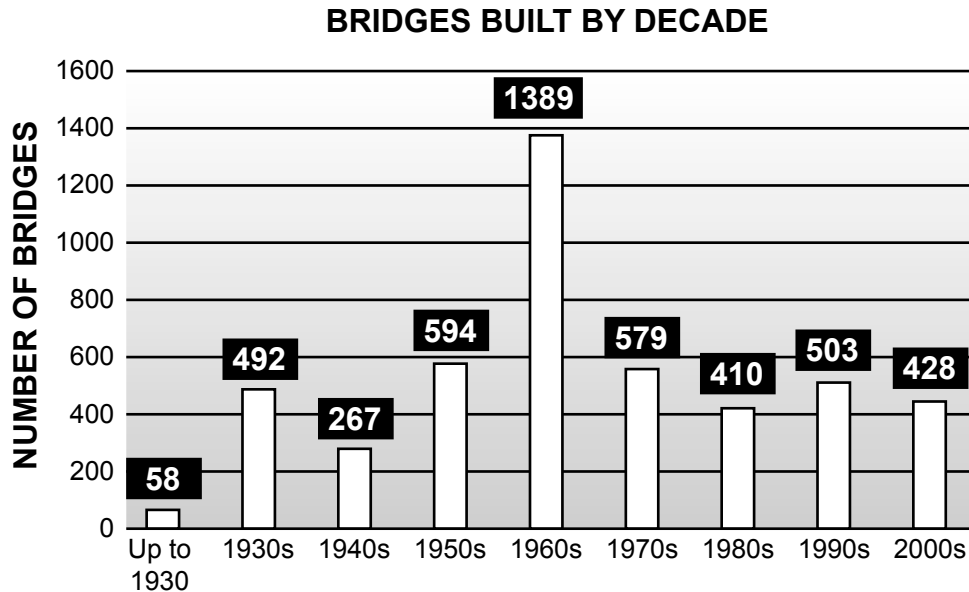
The bridge review ordered by Governor Napolitano reaffirmed the highly rated condition of ADOT bridges and the agency's bridge inspection practices. ADOT staff reviewed more than 800 bridges in the Phoenix and Tucson metropolitan areas as well as a number of structures in rural areas. The results of the review are consistent with recommended actions determined through past bridge inspections. The rigorous bridge review affirmed the need to complete near term bridge repair projects on three bridges and to conduct future repair projects on 45 bridges. The repair needs for these bridges do not compromise their structural integrity. Therefore, the bridges continue to be safe for travelers.



Glen Canyon Bridge on US 89

# Arizona's State Bridges

The state's bridges have annually rated among the best in the nation. The Federal Highway Administration's latest ratings show Arizona as one of the leading states in bridge condition ratings. In 2004, the American Society of Civil Engineers gave Arizona an overall grade of A- for highway bridge safety. The young age of the structures, many of which have been built as part of the Valley's regional freeway system, the state's dry climate, and robust bridge inspection and preservation programs are key reasons for Arizona's excellent condition ratings.



There are 4,720 bridges in the ADOT system, many of which are located in urban areas of the state. More than 70 percent of the 4,720 bridges in the ADOT system have been built since the 1960s, and 1,341 of the state's bridges were built since 1980. Bridges built in the past few decades incorporate modern engineering features and redundant structural systems to enhance the safety and longevity of bridges. The two most common types of bridges in urban areas are:

- Cast-in-place, post-tensioned concrete box girder bridges.
- Pre-cast, pre-stressed concrete girder bridges.



Cast-in-place, post-tensioned: Interstate 10 to Loop 202



Pre-cast, pre-stressed: SR 51 HOV bridge

Both types are known for their durability and structural efficiency. Bridge design and construction has improved dramatically over the past several decades as designers and builders adopted new technologies and methods. Most bridges built in the last 30 years incorporated a certain level of redundancy, which prevents a bridge collapse if a bridge member fractures or fails in some way.



The terms “structurally deficient,” “functionally obsolete,” and “sufficiency rating” became household terms in the wake of the I-35 W bridge collapse in Minneapolis. For many people, these terms can make a bridge sound as if it is unsafe. But, what do they mean?

**Structurally Deficient** – This term means a component of the bridge needs rehabilitation. Namely, the bridge deck, superstructure or substructure condition rating, as determined through a bridge inspection, is below a certain threshold. For example, it could mean the bridge deck – the pavement motorists travel on – is in poor condition and needs repair. A deficient classification does not mean a bridge is likely to collapse or that it is unsafe.

**Functionally Obsolete** – A bridge is considered to be “functionally obsolete” if it has sub-standard geometric features, such as narrow lanes, narrow shoulders, poor approach roadway alignment or inadequate clearance. An example could be an older bridge on an interstate highway that lacks a vertical height of 16 feet, the current standard.

**Sufficiency Rating** – The rating is a numeric value indicative of a bridge’s sufficiency to remain in service. This value varies between 0 and 100 as determined through a bridge inspection. Bridge inspectors rate every component of a bridge using stringent standards co-developed by the Federal Highway Administration and the American Association of State Highway and Transportation Officials.

The terms are used by bridge inspectors to indicate a wide range of bridge issues, some serious, others relatively minor. A “structurally deficient” or “functionally obsolete” rating does not mean a particular bridge is unsafe. Many other factors play a role in determining a bridge’s condition.

Of ADOT’s 4,720 bridges, less than one percent are listed as “structurally deficient.” Bridges listed as “structurally deficient” are being repaired or assessed for future repairs. 133 ADOT bridges are listed as “functionally obsolete,” which represents about three percent of the state’s inventory.

ADOT has only three steel deck truss bridges, similar to the I-35 W Bridge in Minneapolis. All three are located in rural areas of the state. They are:

- Hell Canyon Bridge located on SR 89, MP 346, south of Interstate 40. A thorough inspection was performed in July 2007 and the bridge poses no safety concerns.
- Gila River Bridge at Guthrie on US 191, MP 153. A project to realign this section of US 191, which has been planned for the past decade, begins this year. The highway realignment project will require a new bridge crossing the Gila River. The existing bridge will not be in service once the new bridge is built and the highway realignment project is completed in 2009.
- Little Colorado River Bridge at Cameron on US 89, MP 466. This bridge is being evaluated for repair or replacement as part of a future road improvement project. A thorough inspection in October 2006 revealed no safety concerns.



Little Colorado River Bridge on US 89 at Cameron

# Bridge Preservation and Inspection

A dedicated group of ADOT employees is devoted to providing and maintaining safe and functional bridges and drainage facilities on Arizona highways. They accomplish this by applying modern technology and resources to bridge design, bridge hydraulics, bridge construction assistance and bridge management.

Preservation of existing highway bridges is a primary component of ADOT's mission. As part of the highway infrastructure, bridges constitute substantial assets and their condition directly affects customer satisfaction. ADOT spends more than \$20 million annually for bridge preservation. This does not include dollars that might be spent on bridge preservation as part of a larger road improvement project.

ADOT maintains a bridge management system to evaluate repair needs and coordinate repairs through the Highway Bridge Rehabilitation and Replacement Program. The purpose of the program is to provide dedicated construction funding to restore the structural integrity of a bridge or to replace it. Candidate repair or replacement projects are based upon the bridge sufficiency rating as determined through field inspections. Measurable objectives of the program include completing bridge rehabilitation and replacement projects on time and within budget.

The ADOT Bridge Group is responsible for inspecting bridges on the state highway system in accordance with the National Bridge Inspection Standards and maintaining related bridge inventory records. Through agreements, ADOT also inspects bridges for local and county jurisdictions in Arizona.

The bridge inspection section includes four, two-person teams assigned to cover different geographic areas of the state. Each team consists of a professional engineer and an engineering technician highly trained in bridge inspection. Governor Napolitano and the Arizona Legislature approved funds during the 2007 legislative session for ADOT to hire two more two-person inspection teams.

The agency also uses four on-call consultant teams, made up of professional engineering consultants, to conduct in-depth bridge inspections involving sophisticated equipment and measurements.

Bridge inspection teams rate every component of a bridge according to the National Bridge Inspection Standards. Inspectors visually inspect the bridge looking for cracks or other flaws on the bridge deck, substructure, superstructure and other bridge components. Based on these assessments, additional evaluation may be conducted.

A field inspection of a bridge can take anywhere from a couple of hours to several days, depending on the complexity and condition of the bridge. During the field inspections, bridge inspection teams rate each component of the bridge and identify components needing repair or replacement. The evaluation results in a bridge sufficiency rating to monitor the condition of the bridge over time.

ADOT inspects every bridge at least once every two years and more frequently for any bridge that has known concerns with age, deterioration or damage due to accidents. Any bridge found to have structural safety concerns would be posted with reduced weight limits or closed until the repairs were completed.



Navajo Bridge on US 89A



Burro Creek Bridge on US 93

# Bridge Review

In response to the Governor's order to review highly traveled bridges in urban areas and to report on the review by September 7, 2007, ADOT Bridge Group staff reviewed bridge database records for structures in the Phoenix and Tucson metropolitan areas. Based on this review, two lists of bridges were compiled: the first contained 665 bridges to be reviewed using inspection records, while the second list contained 159 bridges to be assessed in the field.

## Office Review

A total of 665 bridges were reviewed by professional engineers with bridge design experience. Bridge inspection and maintenance folders were reviewed to assess recent records. As a result of the office review, 11 bridges were recommended for further assessment in the field.

## Field Assessment

In addition to the 11 bridges identified through the office review, 159 bridges were selected based on previous bridge inspection condition ratings that were below certain inspection thresholds. Combined, a total of 170 bridges were assessed in the field. In addition to bridges in urban areas, ADOT used the bridge review as an opportunity to conduct field assessments of several bridges in rural areas where previous inspections identified repair needs. Three maps indicating the location of bridges assessed in the field are included in the appendix of this report:

Appendix A - Field assessment locations statewide

Appendix B - Field assessment locations in the Phoenix Metropolitan Area

Appendix C - Field assessment locations in the Tucson Metropolitan Area

Two-person teams consisting of a professional engineer and an engineering technician performed these assessments.

## Current Status of Bridges

The condition of bridges was grouped into the following four categories:

A) Expedited repairs: three bridges are in this category. One bridge was missing sections of bridge railings, one requires a girder bearing seat repair and one requires an abutment repair. Efforts are underway to take action for these repair projects this year. The structural integrity of these three bridges is not compromised due to these repair needs. Therefore, the bridges are safe for travelers.

B) Bridge repair projects to be scheduled for future construction: 45 bridges are in this category. Typical repair recommendations range from bridge deck rehabilitation to secondary member repairs such as repairing bracing members. The structural integrity of these 45 bridges is not compromised due to these repair needs. Therefore, the bridges are safe for travelers.

C) Recommendations requiring engineering evaluation: 24 bridges are in this category. Typical recommendations are to monitor certain conditions for possible future repair needs. These bridges continue to be safe for travelers.

D) No Current Repair Recommendations: 98 bridges are in this category.

The repair projects are consistent with those identified through previous bridge inspections. Actions are being taken to address the repairs.

## Conclusions

The bridge review ordered by Governor Napolitano confirmed the condition of the state's bridges and demonstrated that Arizona bridges are safe to travel. The review also provided the opportunity to assess ADOT's bridge inspection process and review practices to document the condition of our bridges. The review highlighted the fact that a thorough bridge inspection and preservation program is vital to maintain the condition of the state's bridge infrastructure.

The results from the review are consistent with previously recommended actions through past bridge inspection findings. As a result of the rigorous bridge review that ADOT conducted, we will be expediting repairs to three bridges and making future repairs to 45 bridges to address all recommended repairs that fall into categories A and B that are described above.

## **Appendix A - Field Assessment Locations Statewide**



## Field Assessment Locations of State Highway Bridges

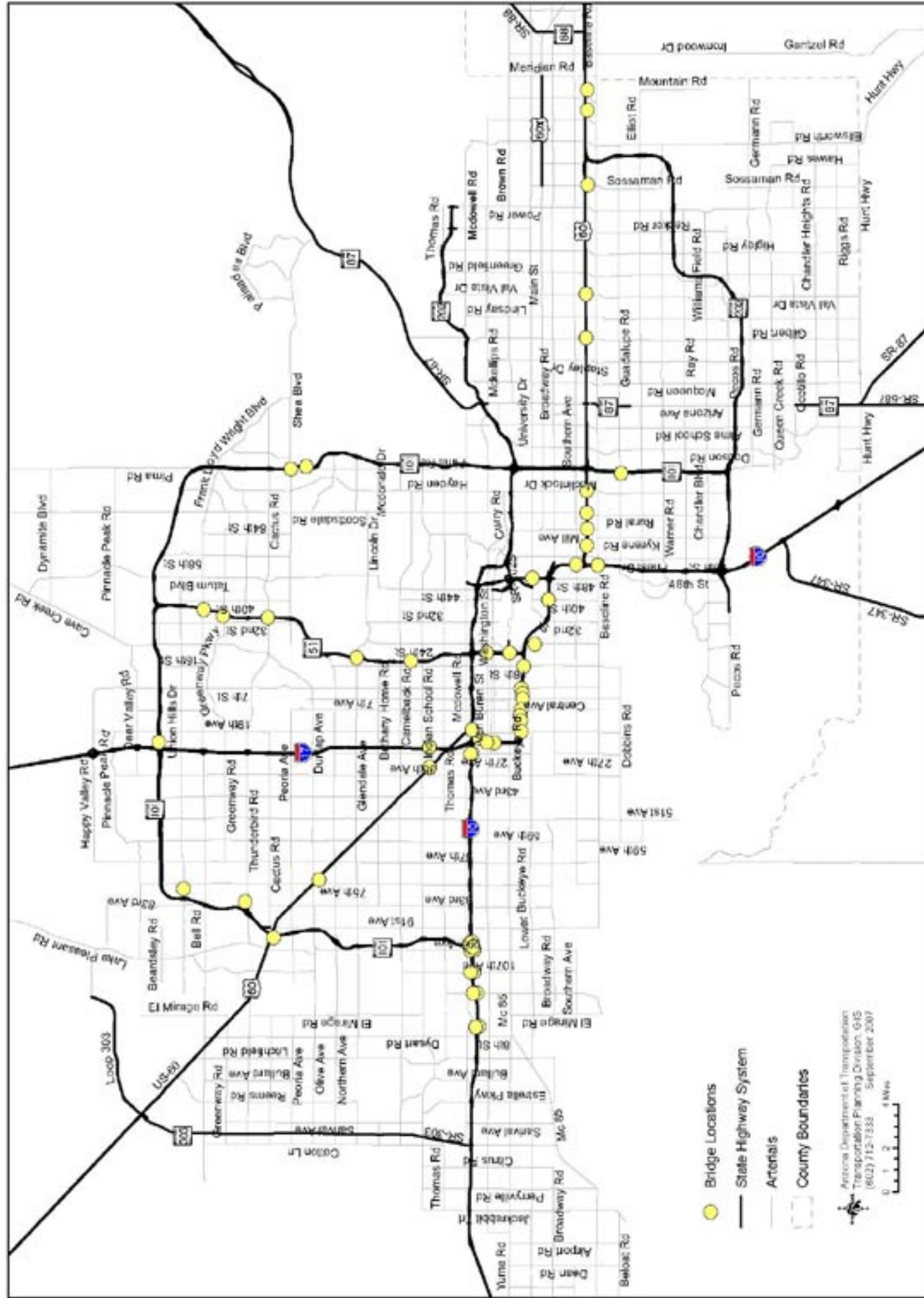


- Bridge Locations
- Cities and Towns
- State Highway System
- County Boundaries



## **Appendix B - Field Assessment Locations in the Phoenix Metropolitan Area**

# Field Assessment Locations of State Highway Bridges - Phoenix Metro



Arizona Department of Transportation  
 Transportation Planning Division, GIS  
 (602) 712-7333 September 2007

## **Appendix C - Field Assessment Locations in the Tucson Metropolitan Area**

# Field Assessment Locations of State Highway Bridges - Tucson Metro

